There are two coins. Coin A is fair: It has heads on one side and tails on the other. Coin B has heads on both sides. You choose a coin at random, flip it twice, and observe two heads. What is the probability that you chose coin A?

**Solution:** Let $A$ be the event I chose the first coin and $H$ be the event of two consecutive heads. Bayes’ rule says that

$$P(A|H) = \frac{P(H|A)P(A)}{P(H|A)P(A) + P(H|A^c)P(A^c)} = \frac{P(H|A)}{P(H|A) + P(H|A^c)}$$

because $A$ and $A^c$ have (unconditional) probability 1/2. Since $P(H|A) = 1/4$ and $P(H|A^c) = 1$, we get that $P(A|H) = 1/5$. 